

Cetradonia linearis, Rock Gnome Lichen

Assessment by: Allen, J., Lendemer, J. & McMullin, T.



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Fungi	Ascomycota	Lecanoromycetes	Lecanorales	Cladoniaceae

Taxon Name: *Cetradonia linearis* (A.Evans) J.C.Wei & Ahti

Synonym(s):

- *Cladonia linearis* A.Evans

Common Name(s):

- English: Rock Gnome Lichen

Assessment Information

Red List Category & Criteria: Vulnerable C1 [ver 3.1](#)

Year Published: 2015

Date Assessed: August 11, 2015

Justification:

Assessment Synopsis – *Cetradonia linearis* is a fruticose species that grows on rock outcrops and boulders and is narrowly endemic to the southern Appalachians. This species is threatened by habitat degradation due to invasive tree pests, climate change and resource extraction. Continued protection under the Endangered Species Act is required to ensure that this species does not decline.

Distinguishing Traits – The Rock Gnome Lichen looks like patches of small green fingers (squamules) growing out from rock outcrops and boulders. It is often fertile and bears black apothecia at the ends of the podetia. The podetia are solid, and occasionally branched.

Explanation of Chosen Red List Category and Criteria – This species warrants listing as **Vulnerable under criterion C1**. There are ~4,000 mature individuals documented throughout the range of *Cetradonia linearis*. The number of mature individuals was calculated from element occurrence records held by national forests, natural heritage programs, and national parks from throughout the range of the species. A mature individual was considered a distinct colony that is producing apothecia.

A generation time for this species is estimated to be 33 years, so three generations is a total of 99 years. A minimum 10% decline is projected for this species within the next three generations due to a combination of 1) *Abies fraseri* mortality caused by the Balsam Woolly Adelgid and climate change (Farjon 2013a), 2) *Tsuga canadensis* mortality caused by the Hemlock Woolly Adelgid (Farjon 2013b), and 3) climate change impacting cloud immersion regimes for high-elevation subpopulations (Cullata and Horton 2014).

Geographic Range

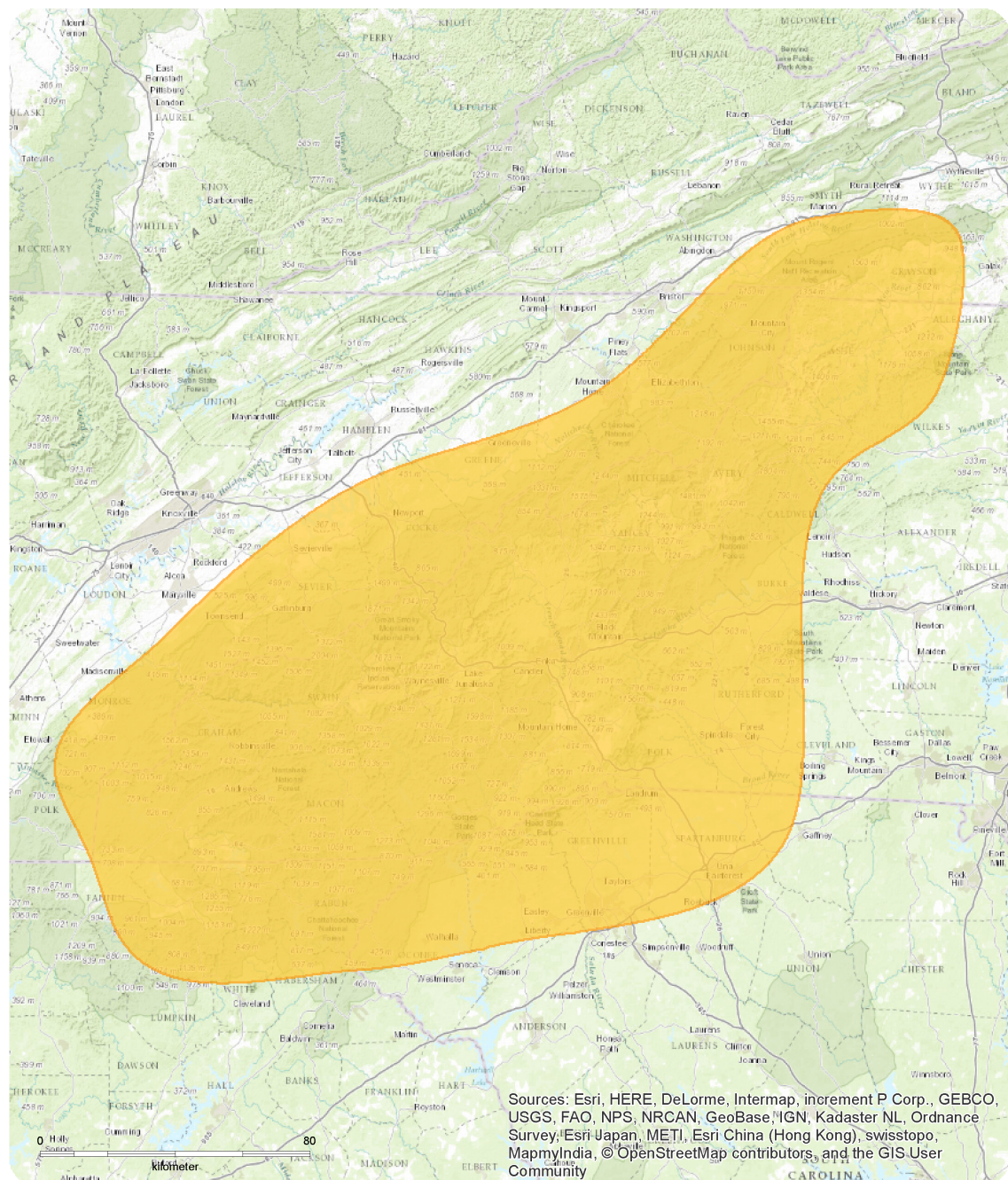
Range Description:

This species is narrowly endemic to the southern Appalachians of eastern North America (US), including Virginia, North Carolina, South Carolina, Tennessee, and Georgia.

Country Occurrence:

Native: United States (Georgia, North Carolina, South Carolina, Tennessee, Virginia)

Distribution Map

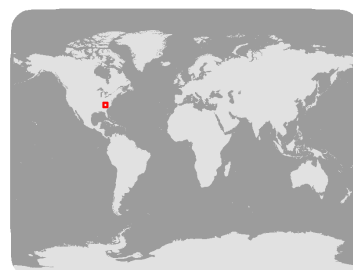


Cetradonia linearis

Range

Extant (resident)

Compiled by:
International Union for the
Conservation of Nature



The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.



Population

There are 77 locations in North Carolina, seven in Tennessee and one location each in Georgia, South Carolina and Virginia (USFWS 2013). In total, there are ~4,000 mature individuals documented throughout the range of *Cetradonia linearis*. The number of mature individuals was calculated from element occurrence records held by national forests, natural heritage programs and national parks from throughout the range of the species. A mature individual was considered a distinct colony that is producing apothecia. When the number of individuals was not explicitly documented, it was calculated from the total reported cover, where a mature individual was presumed to be 10 cm in diameter. Thus, if a site was documented to have 1.0 m² cover, it was estimated to consist of 100 individuals. Sites on high-elevation rock outcrops with extensive coverage were calculated differently as their average colony size is often about 1.0 m² ranging up to many square meters for a single colony, thus 1.0 m² was used as the colony size for large, high-elevation locations (e.g., Devil's Courthouse and Whiteside Mountain). Sites in streams in Great Smoky Mountains were estimated to consist of 100 individuals based on the experience of the author, since no detailed observation data was available.

Current Population Trend: Decreasing

Habitat and Ecology (see Appendix for additional information)

Cetradonia linearis is found in two different habitat types. Large colonies are found on high-elevation cliffs and rock outcrops, and lower elevation rock outcrops with seeping water. It is also frequently found in smaller patches on boulders in shaded, small to medium sized streams at middle to high elevations.

Systems: Terrestrial, Freshwater

Use and Trade

This species is not utilised.

Threats (see Appendix for additional information)

As many occurrences of *Cetradonia linearis* occur in spruce-fir forests, impacts to this highly threatened ecosystem also pose a threat to this species (White *et al.* 2010). Currently, the greatest concern in these ecosystems is the Balsam Woolly Adelgid, which is decimating Fraser's Fir throughout its range (Rose and Nicholas 2008, Rollins *et al.* 2010, White *et al.* 2010, Farjon 2013a). Lower elevation subpopulations are threatened by losses of hemlocks (*Tsuga* sp.) due to the Hemlock Woolly Adelgid (Krapfl *et al.* 2011). There have been recorded declines abundance and health of *C. linearis* in forests that are heavily impacted by the Balsam Woolly Adelgid (North Carolina Element Occurrence Report 2015). The high-elevations in this region are characterized by daily, extensive cloud immersion; however, changes in these humidity regimes and cloud immersion have recently been documented (Culatta and Horton 2014). These changes will likely impact *Cetradonia linearis* subpopulations negatively as this species is not tolerant of heat and desiccation. If this species were no longer protected under the Endangered Species Act, subpopulations could be threatened by resource extraction, such as logging and mining, and road building and maintenance. However, as long as its legal protection status continues subpopulations on public lands will continue to be protected.

Conservation Actions (see Appendix for additional information)

Monitoring the subpopulations of this species for health and abundance is the most important conservation action. First, monitoring techniques must be standardized for this species. After standard techniques are established annual or bi-annual monitoring must be conducted for subpopulations throughout the range of this species. If a decline in the species is detected, the status should be reassessed, and required actions to halt the force driving the decline should be taken. For instance, the possibility of transplanting this species should be investigated to determine whether or not reintroduction is a possibility.

Credits

Assessor(s): Allen, J., Lendemer, J. & McMullin, T.

Reviewer(s): Scheidegger, C.

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External Resources

For [Images and External Links to Additional Information](#), please see the Red List website.

Appendix

Habitats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Habitat	Season	Suitability	Major Importance?
1. Forest -> 1.4. Forest - Temperate	-	Suitable	-
5. Wetlands (inland) -> 5.1. Wetlands (inland) - Permanent Rivers/Streams/Creeks (includes waterfalls)	-	Suitable	-
0. Root -> 6. Rocky areas (eg. inland cliffs, mountain peaks)	-	Suitable	-

Threats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Threat	Timing	Scope	Severity	Impact Score
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.3. Unintentional effects: (subsistence/small scale)	Past, unlikely to return	Majority (50-90%)	Rapid declines	Past impact
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.4. Unintentional effects: (large scale)	Past, unlikely to return	Majority (50-90%)	Rapid declines	Past impact
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
8. Invasive & other problematic species & genes -> 8.1. Invasive non-native/alien species -> 8.1.2. Named species (Adelges piceae)	Future	Majority (50-90%)	Rapid declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects		
8. Invasive & other problematic species & genes -> 8.1. Invasive non-native/alien species -> 8.1.2. Named species (Adelges tsugae)	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.3. Indirect ecosystem effects		
11. Climate change & severe weather -> 11.1. Habitat shifting & alteration	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Actions in Place
In-Place Research, Monitoring and Planning
Action Recovery plan: No
Systematic monitoring scheme: Yes
In-Place Land/Water Protection and Management
Conservation sites identified: Yes, over entire range
Occur in at least one PA: Yes
Percentage of population protected by PAs (0-100): 91-100
Area based regional management plan: No

Conservation Actions Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection
1. Land/water protection -> 1.2. Resource & habitat protection
2. Land/water management -> 2.1. Site/area management
2. Land/water management -> 2.2. Invasive/problematic species control
3. Species management -> 3.2. Species recovery
3. Species management -> 3.3. Species re-introduction -> 3.3.2. Benign introduction

Research Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Research Needed
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.3. Life history & ecology
1. Research -> 1.6. Actions
2. Conservation Planning -> 2.1. Species Action/Recovery Plan
2. Conservation Planning -> 2.2. Area-based Management Plan
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km ²): 296
Continuing decline in area of occupancy (AOO): No
Extreme fluctuations in area of occupancy (AOO): No
Estimated extent of occurrence (EOO) (km ²): 18124
Extreme fluctuations in extent of occurrence (EOO): No
Number of Locations: 87
Continuing decline in number of locations: No
Extreme fluctuations in the number of locations: No
Lower elevation limit (m): 1400
Upper elevation limit (m): 1700
Population
Number of mature individuals: 4154
Continuing decline of mature individuals: Yes
Extreme fluctuations: No
Population severely fragmented: No
Continuing decline in subpopulations: No
Extreme fluctuations in subpopulations: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: No
Generation Length (years): 33

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